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(21) International Application Number: PCT/US94/05493 (22) International Filing Date: 20 May 1994 (20.05.94) (30) Priority Data: 93027586 21 May 1993 (21.05.93) RU (71) Applicant (for all designated States except US): RUSSIAN TECHNOLOGY GROUP [US/US]; Suite 214, 1670 S. Amphlett Boulevard, San Mateo, CA 94402 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): GVON, Khan Ir [RU/RU]; pr. Patsaeva, 14-26, Moscow Region, 141700, Dolgoprudnyy City (RU). BOBROV, Yuri A. [RU/RU]; Zelenograd., 906-128, Moscow, 103575 (RU). BYKOV, Victor A. [RU/RU]; Zelenograd., 815-200, Moscow, 103527 (RU). IGNATOV, Leonid Y. [RU/RU]; ul. Angarskaia, 20-3-81, Moscow, 127635 (RU). IVANOVA, Tatiana D. [RU/RU]; Zelenograd., 200-"G"-144, Moscow, 103305 (RU). POPOV, Sergei I. [RU/RU]; ul. Profsoyuznaia, 96-4-11, Moscow, 117485 (RU). SHISHKINA, Elena Y. [RU/RU]; ul. Angarskaia, 57-2-94, Moscow, 127412 (RU). VOROZHTSOV, Georgiy N. [RU/RU]; ul. Sadovaia-Spasskaia, 21-268, Moscow, 107078 (RU).	(74) Agents: SHENKER, Michael et al.; Skjerven, Morrill, MacPherson, Franklin & Friel, Suite 700, 25 Metro Drive, San Jose, CA 95110 (US). (81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.	

(54) Title: THERMOSTABLE AND LIGHTFAST DICHROIC LIGHT POLARIZERS**(57) Abstract**

Polarizing coatings are formed from dyestuffs which provide a stable liquid crystalline phase in a wide range of concentrations, temperatures and pH-values. Particles formed by aggregates of the liquid crystal molecules are oriented in a predetermined direction to polarize light. The stability of the liquid crystalline state allows orienting the particles by mechanical forces such as a shearing force applied when the liquid crystal (10) is spread on a support surface (20) by a knife-like doctor (90) or a tension deformation force acting on the meniscus of the liquid crystal deposited between two surfaces (20, 30) as the surfaces are peeled off one another. As a result, the polarizing coatings are formed in some embodiments by simple methods. In some embodiments, the polarizing coatings have a high lightfastness, a high thermal stability, and a high dichroic ratio.

WE CLAIM:

1. A dichroic polarizer comprising a water soluble organic dyestuff of the formula:



wherein:

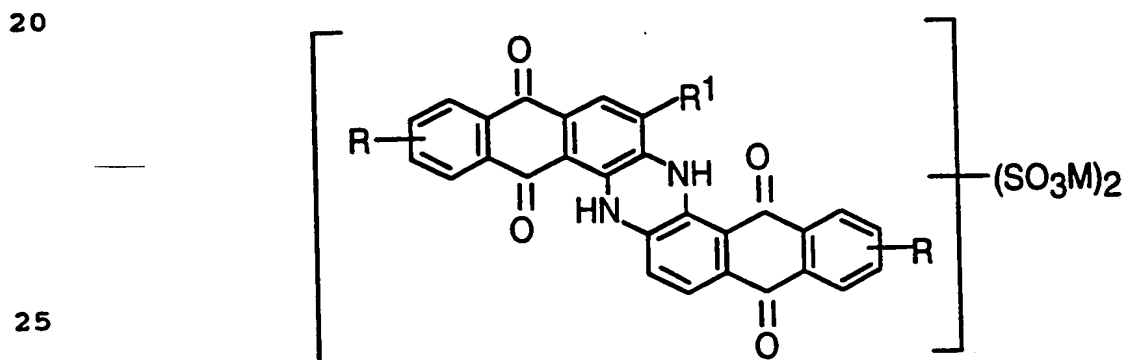
the Chromogen is such that the dyestuff is capable of existing in a stable liquid crystalline phase;

10 M is a cation; and

the dyestuff comprises molecules aggregated into particles that are oriented in a predetermined direction to enable the dyestuff to polarize light if the light is transmitted through the dyestuff.

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2. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



wherein:

R¹ = H or Cl;

R = H, Alk, ArNH, or ArCONH;

Alk is an alkyl group; and

Ar is a substituted or unsubstituted aryl radical.

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3. The dichroic polarizer of Claim 2 wherein Alk is an alkyl group with 1 to 4 carbon atoms.

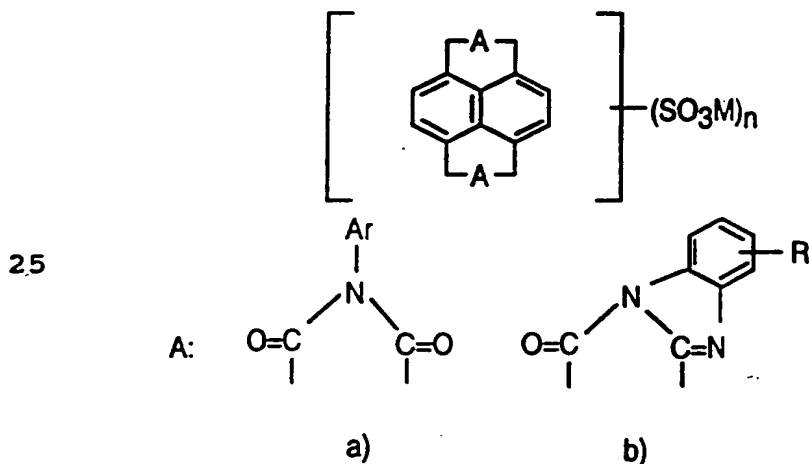
4. The dichroic polarizer of Claim 3 wherein Alk is one of CH₃, C₂H₅.

5. The dichroic polarizer of Claim 2, 3 or 4 wherein Ar is a substituted or unsubstituted phenyl radical.

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6. The dichroic polarizer of Claim 5 wherein Ar is one of C₆H₅, 4-ClC₆H₄.

7. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



wherein

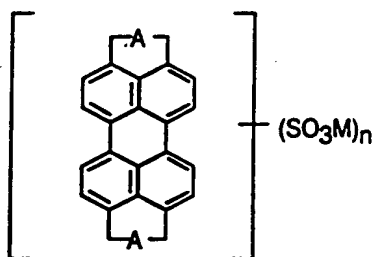
R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

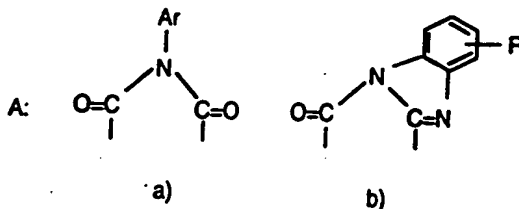
n = 2 or 3.

8. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:

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wherein:

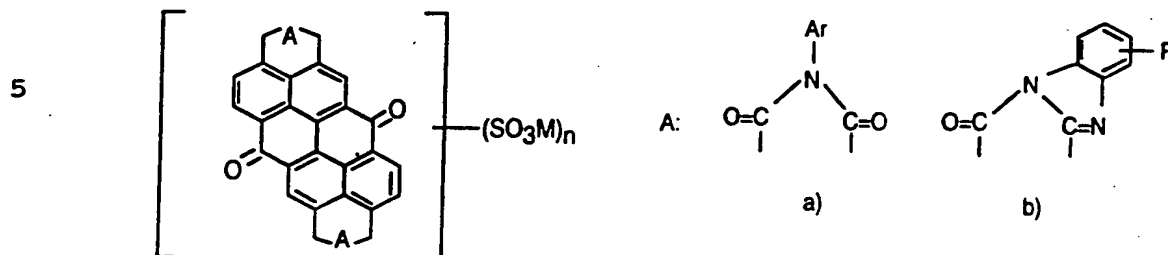
R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

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n = 2 or 3.

9. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



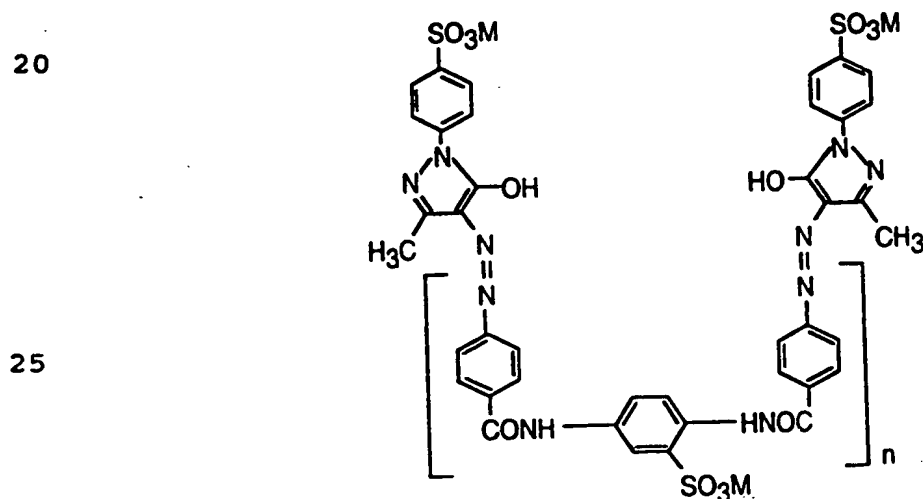
10 wherein:

R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

15 $n = 2$ or 3 .

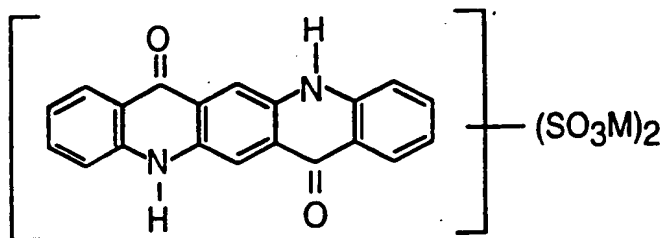
10. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



wherein $n = 3, 4$ or 5 .

11. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:

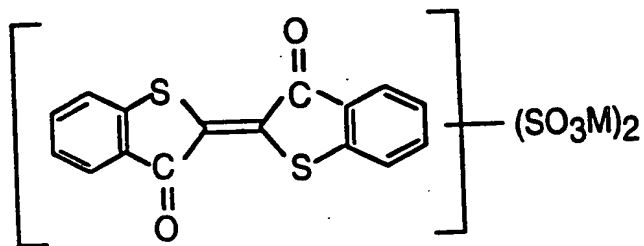
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12. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:

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13. The dichroic polarizer of Claim 7, 8 or 9 wherein:

R is H; or an alkyl group with 1 to 4 carbon atoms; or an alkoxy group with 1 to 2 carbon atoms; or Br; or Cl.

25

14. The dichroic polarizer of Claim 13 wherein R is CH_3 or C_2H_5 .

15. The dichroic polarizer of Claim 13 wherein
5 R = CH_3O .

16. The dichroic polarizer of one of Claims 7-9, 13-15 wherein Ar is a substituted or unsubstituted phenyl radical.

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17. The dichroic polarizer of Claim 16 wherein R is C_6H_5 , $4\text{-CH}_3\text{OC}_6\text{H}_4$, $4\text{-C}_2\text{H}_5\text{OC}_6\text{H}_4$, $4\text{-ClC}_6\text{H}_4$, $4\text{-C}_4\text{H}_9\text{C}_6\text{H}_4$, or $3\text{-CH}_3\text{C}_6\text{H}_4$.

15 18. The dichroic polarizer of one of Claims 1-17 wherein M is H^+ , a metal of the first group, or NH_4^+ .

19. The dichroic polarizer of Claim 18 wherein M is H^+ , Li^+ , Na^+ , K^+ , Cs^+ , or NH_4^+ .

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20. A process for making a light-polarizing element, the process comprising the steps of:

forming a solution of a dyestuff on a surface of a support wherein the dyestuff is in a liquid
25 crystalline state;

orienting, by an orienting force, molecules or supra-molecular complexes of the dyestuff in the liquid crystalline state in a predetermined

direction to enable the dyestuff to polarize transmitted light;

5 removing the orienting force, the molecules or supra-molecular structures remaining oriented and the dyestuff remaining in the liquid crystalline state; and

evaporating a solvent from the solution while the molecules or supra-molecular complexes of the dyestuff remain oriented.

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21. The process of Claim 20 wherein the orienting force is a shearing force.

15 22. The process of Claim 21 wherein the shearing force is applied by a doctor moving relative to the support surface, the doctor being in contact with the solution.

20 23. The process of Claim 20 wherein the orienting step comprises the step of tension deformation in a meniscus of the dyestuff solution during a wedging separation of the support surface from another surface contacting the dyestuff solution.

25 24. The process of Claim 23 wherein the support is a flexible film, the other surface is a surface of another flexible film, and the tension deformation in

the meniscus is created as the two flexible films are being separated from each other.

25. The process of Claim 23, wherein the support
5 surface is a hard surface and the other surface is a surface of a flexible film.

26. The process according to Claim 23, wherein
the other surface is a surface of a cylinder rolling
10 relative to the support surface.